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FINAL REPORT

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F/NAS/ Pressure Temperature Retrieval Techniques

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Purpose

The purpose of this investigation is to study methods and ways for rapid inversion programs involving the correlated k-method, and to modify the existing programs so that the rapid analysis of data can be accomplished.

Background

The earth's atmosphere as well as those around the planets consist of gases which emit radiation in the infrared spectral region, providing wealth of information about chemical and physical processes in the atmosphere. The atmospheric molecular constituents absorb and radiate by vibrational and rotational transitions, and the observed spectra exhibit characteristic spectral features in the region of the electromagnetic spectrum. The observed absorption or thermal emission spectra may be obtained with space-born high resolution infrared spectrometers the 50-1000 micrometers spectral region. A detailed analysis of the observed spectra leads to information about the atmospheric thermal structure, composition, and the physical and chemical processes. The analytic techniques involve the development of radiative transfer models for the calculation of the observed radiance and transmittances for realistic atmospheric conditions and observational geometries, and the development of inversion methods for retrieval of atmospheric parameters from the observations.

A capability for analysis and interpretation of infrared emissions and absorption measurements is being developed at the Space Flight Center by modification of existing programs for applications to the currently operating or planning mission for ground based and space-born observations. These missions include infrared observations of Saturn and Titan with CIRS instrument on the Cassinni orbiter, and ATMOS solar calculation limb observations of the earth's atmosphere from the Shuttle platform.

Accomplishments

During this period extensive modifications of the software programs were introduced. These modifications were imposed on the radiative transfer models and inversion methods employed by Marshall Space Flight Center. In addition, these modifications resulted in incorporating some important atmospheric processes that have not been considered up to date.

In additional to the above accomplishments during the grant period, the following additional work was accomplished and/or started to be implemented.

1) The software was improved to handle several toxic gases such as O3, H2O etc.
2) The software was improved to handle gases such as CH4, NH3 etc. which were observed in Saturn's atmosphere.
3) Finally, the software was further improved to retrieve pressure-temperature profiles from infrared solar absorption spectra.